Space Weather Technical Forecast

Issued on Thursday, 29 August 2024 at 01:15 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: M-class flares likely. Ongoing CME influence waning Day 1 (29 Aug), chance G1/Minor Storms.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity has been Low with a peak C6.9 flare at 28/1804 UTC from AR3806 on the southeast limb. There are now thirteen sunspot regions on the visible disc. A new region on the southeast limb has been numbered AR3806, and whilst the viewing angle is still making it difficult to classify, it appears to be a compact region. It may be a couple of days before we get a true idea of the magnetic complexity, however. AR3800, in the southwest quadrant, is starting to show some weak mixed polarity spots. AR3799, also in the southwest, has a very large leading spot but the trailing spots are extremely faint now. The remaining regions on the disc are either small or magnetically simple and mostly stable at present.

No Earth-directed CMEs were observed in the past 24 hours.

Solar Wind / Geomagnetic Activity: Solar wind parameters, as measured by ACE at L1, indicated ongoing influence from a CME that arrived early on 27 Aug. Despite this wind speeds were slow, mainly varying between 280-350 km/s. The density was average or below. The Interplanetary Magnetic Field, Bt, was strong, mainly between 15-18nT. The north-south component, Bz, was initially moderately to strongly southward directed until 28/0730 UTC (peak -15nT) before becoming mostly weakly negative but with some brief peaks near -10nT. Phi angle was initially positive (away from the Sun) until 28/0200 UTC, before becoming negative (towards the Sun).

Resultant Geomagnetic activity was initially at G2/Moderate Storm (Kp6) levels until 28/0300 UTC, before easing to Active (Kp4) to G1/Minor Storm (Kp5) levels from 28/0300-0900 UTC. Activity has been Quiet to Unsettled (Kp 2-3) since then.

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 remained at background levels. High energy electron flux (greater than 2MeV) observed at GOES16 was at background levels. The 24-hour fluence was below the Active threshold, with 9.07e5 integrated pfu observed at 29/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity is forecast with M-class flares likely and a slight chance of isolated X-flares occurring.

Solar Wind /Geomagnetic Activity: Earth is currently under CME influence, with this expected to gradually ease in the next 24 hours. No other Earth-directed CMEs feature in the forecast. Coronal hole 62/+ west of centre disc may give an enhancement to the solar wind on Days 1 and 2 (29-30 Aug), potentially reaching slightly elevated levels. However, confidence is low in this feature. MOSWOC Enlil is forecasting a much stronger HSS on Day 4 (01 Sep), from an as yet unnumbered negative polarity coronal hole in the southeast disc. Elevated wind speeds are possible from this feature.

Geomagnetic activity is expected to be at Quiet to Active levels on Day 1, with a chance of G1/Minor Storm intervals should the Bz turn southward directed for a period of time. Conditions are then most likely to be Quiet to Unsettled through much of the rest of the period, but with a chance of Active intervals under any HSS influence, mainly on Days 2 and 4.

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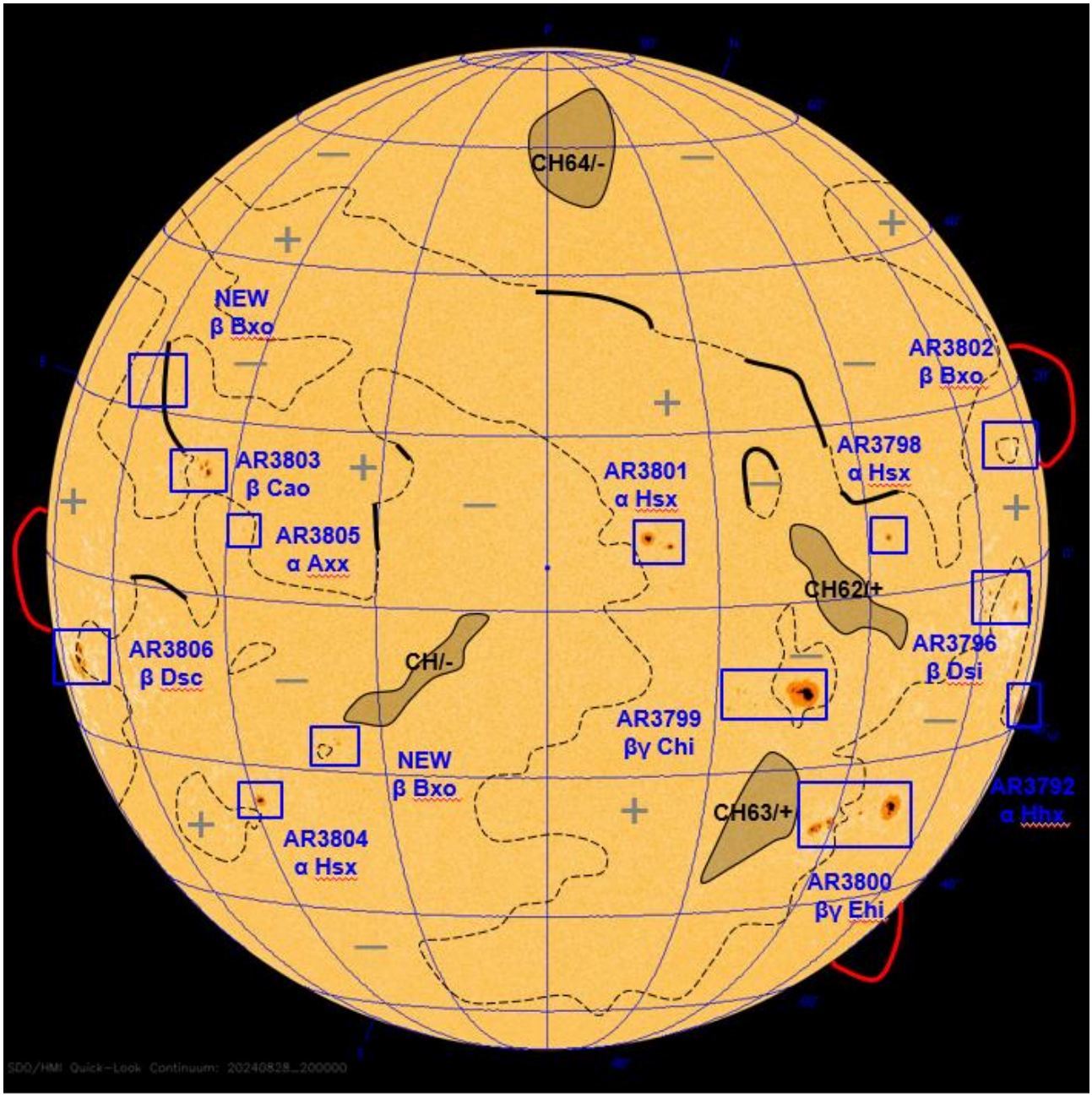
Met Office Space Weather Technical Forecast

Energetic Particles / Solar Radiation: High energy proton flux is likely to remain at background levels, but with a slight chance of reaching the S1 Minor Radiation Storm level, should any larger flares occur, especially from the western disc. High energy electron flux is expected to remain at mainly background levels. The associated 24-hour fluence is expected to persist below the Active level.

Figure 1. Solar Analysis Valid 28/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

The CME that was seen leaving the Sun on 23 Aug arrived at L1 early on 27 Aug. Earth currently lies within the magnetic cloud from this feature, with enhanced solar wind parameters that are expected to gradually ease in the next 24 hours. No other Earth-directed CMEs feature in the forecast.

Solar winds are currently at slow ambient levels. Coronal hole 62/+ west of centre disc may give an enhancement to the solar wind on Days 1 and 2 (29-30 Aug), potentially reaching slightly elevated levels. This coronal hole was not clearly present in imagery on the previous rotation, with the solar wind parameters contaminated by previous CME impacts, but no obvious High Speed Stream (HSS). MOSWOC Enlil is forecasting a slight enhancement which started on 28 August, meaning that confidence is low in the outcome. Another coronal hole (63/+) in the southwest disc is likely too far south on the disc to result in any notable enhancement at Earth. MOSWOC Enlil is forecasting a much stronger HSS on Day 4 (01 Sep), which may be due to an as yet unnumbered coronal hole currently in the southeast disc. This appears to be a relatively small feature, but on the equivalent of Day 4 on the previous rotation there was some suggestion in the solar wind parameters of a HSS reaching elevated levels, although there was also CME contamination during this period. This coronal hole being negative polarity, however, means that geomagnetic impacts are unlikely at this time of year.

Geomagnetic activity is expected to be at Quiet to Active levels on Day 1, with a chance of G1/Minor Storm intervals should the Bz turn southward directed for a period of time. Conditions are then most likely to be Quiet to Unsettled through much of the rest of the period, but with a chance of Active intervals under any HSS influence, mainly on Days 2 and 4.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	30	5	1	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

No Earth directed CMEs are currently expected.

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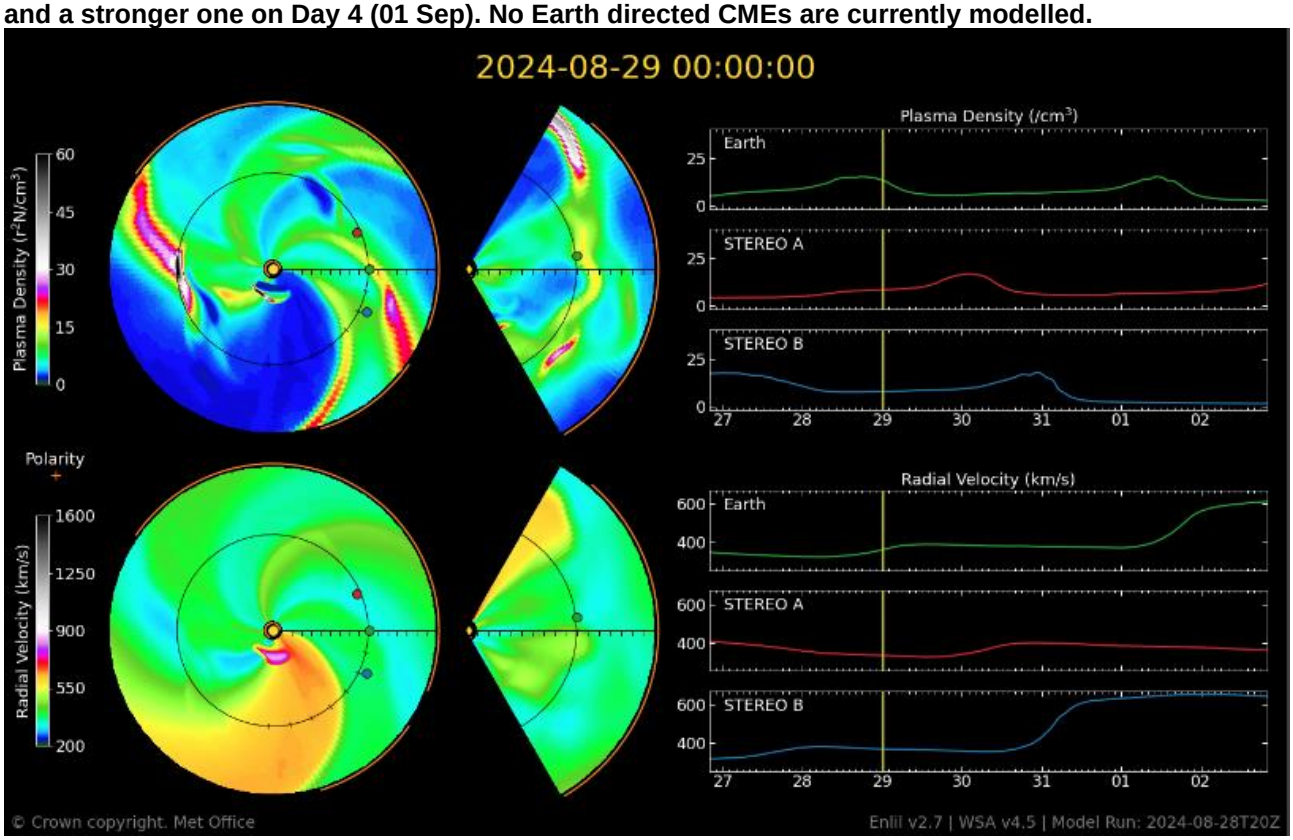
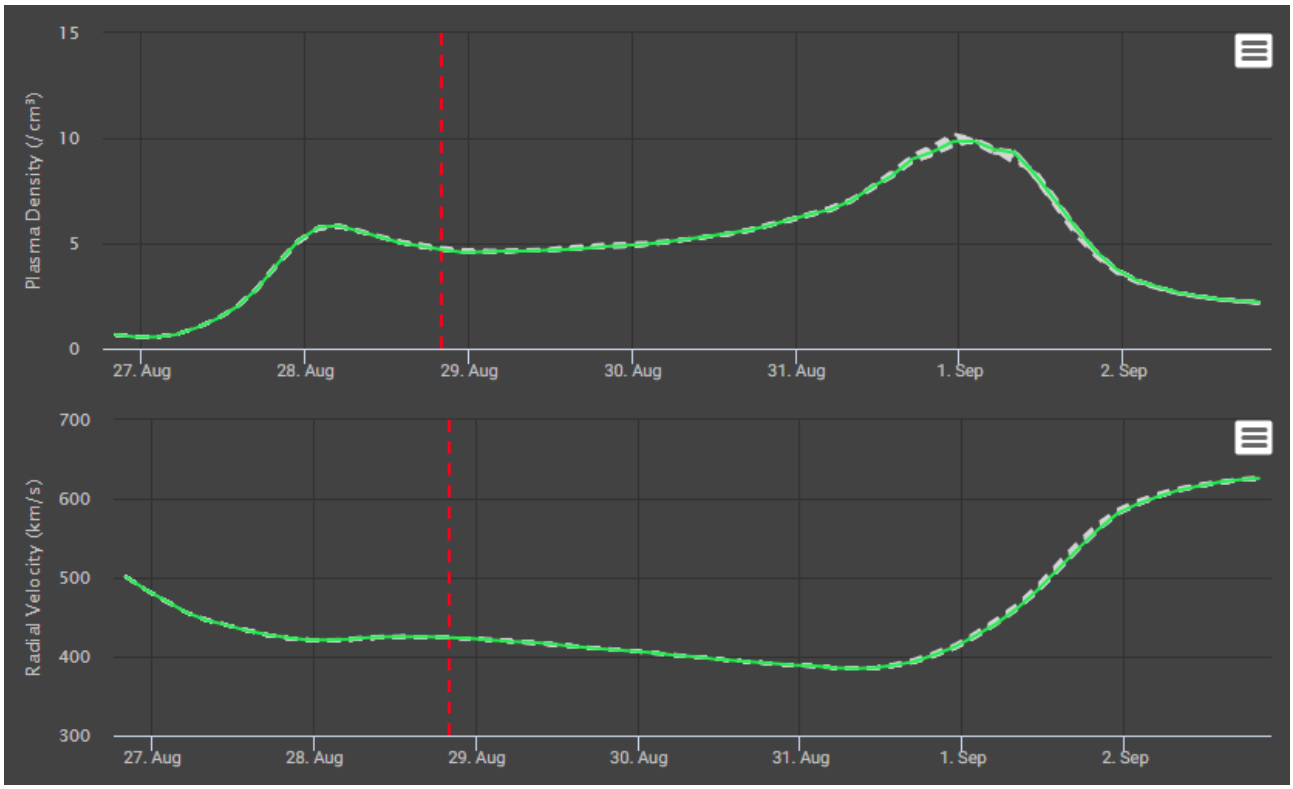
Figure 2: MOSWOC Enlil and ensemble, showing a slight increase in wind speeds in the near future, and a stronger one on Day 4 (01 Sep). No Earth directed CMEs are currently modelled.





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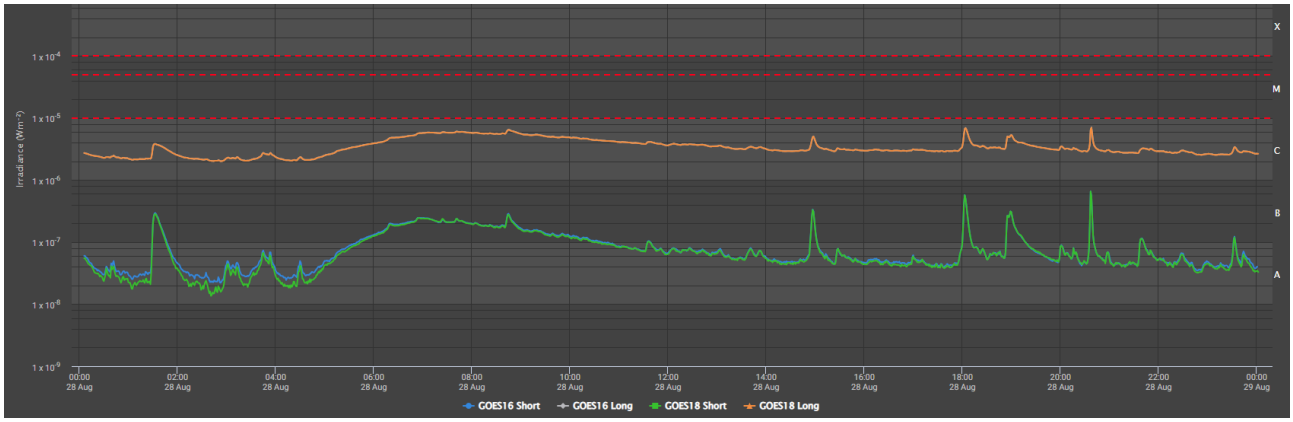
Radio Blackouts - X-Ray Flares:
Flare activity is expected to be Low to Moderate, with M-class flares considered likely and a slight chance of isolated X-class flares, these perhaps now most likely from AR3806.

There are now thirteen sunspot regions on the visible disc. A new region on the southeast limb has been numbered AR3806, and whilst the viewing angle is still making it difficult to classify, appears to be a compact region. It may be a couple of days before we get a true idea of the magnetic complexity, however. AR3800, in the southwest quadrant, is starting to show some weak mixed polarity spots. AR3799, also in the southwest, has a very large leading spot but the trailing spots are extremely faint now. The remaining regions on the disc are either small or magnetically simple and mostly stable at present.

There are five regions due to rotate off the disc during this period, most of which are not contributing significantly to the flare risk. Of these, AR3800 rotates off during Day 4 (01 Sep) and is the highest flare risk of the five regions, but the overall flare risk will not drop until after the end of this period, when it is properly over the limb. In the meantime, ex-AR3780 is due to rotate back onto the disc later in this period which may balance out any losses over the west limb.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	65	65	65	65
Very Active	R3 to R5 X Class	No	10	10	10	10

Figure 3: X-ray flux at GOES16 and 18, with only C-class flares in the last 24 hours.



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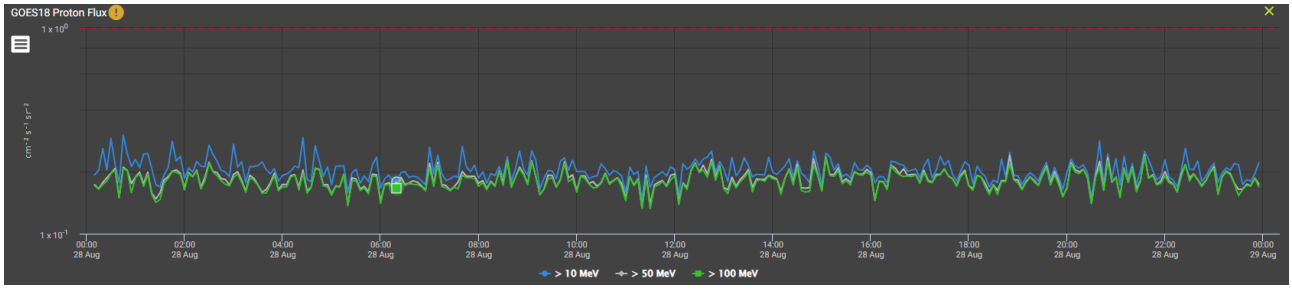
Solar Radiation Storms - (High Energy Protons):
High energy proton flux, as observed by GOES-18, is currently at background levels and is likely to persist at this level. There are a number of moderately sized sunspot regions in the western hemisphere which are moving into an increasingly favourable position to give proton enhancements at L1, should any significant flares occur. However, these regions currently lack magnetic complexity. Consequently, there is currently a slight chance of exceeding the S1/Minor Radiation Storm threshold through this period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	10	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: Proton flux recorded at GOES18, with background levels at present.



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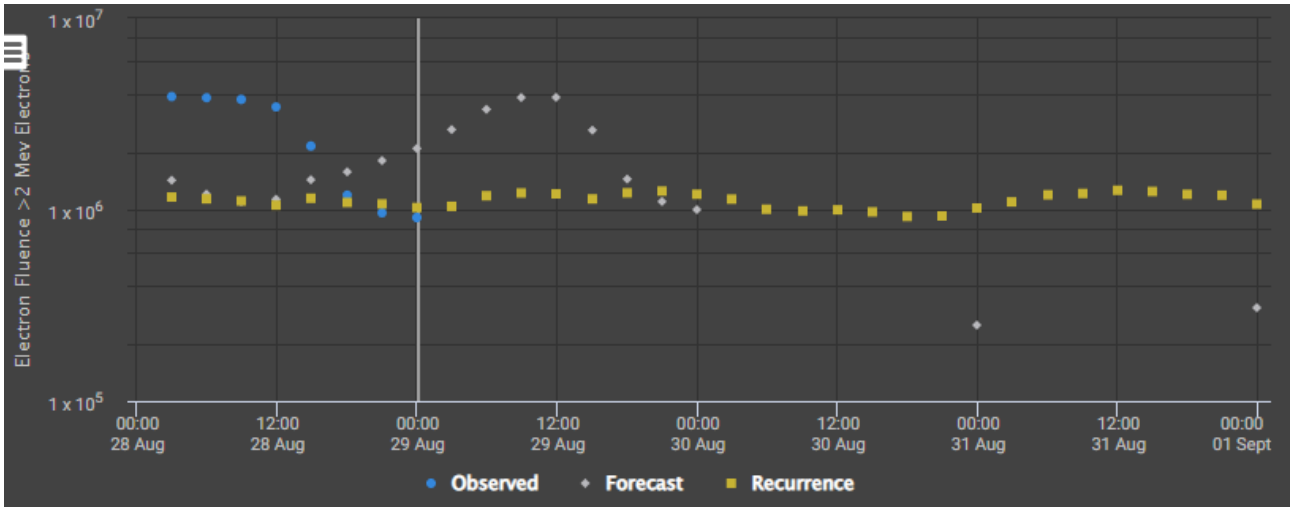
High Energy Electrons Event (≥ 2MeV):
High energy electron flux as observed by GOES-16 is currently at background levels, and is likely to remain that way during this period. No significant wind speed increases are anticipated until potentially the very end of the period, with any rises in electron flux not expected until after the end of Day 4 (01 Sep).

Fluence is expected to remain below the Active (1e8 integrated pfu) threshold through the period. MOSWOC REFM is suggesting a similar story with below Active fluence, which is accepted.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	1	1	1
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 5: MOSWOC REFM showing a below Active forecast through the next three days.



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